Twenty-fourth Annual Report

OF THE

North Dakota Agricultural Experiment Station

AGRICULTURAL COLLEGE
NORTH DAKOTA

TO

THE GOVERNOR OF NORTH DAKOTA

1914

Twenty-fourth Annual Report

OF THE

North Dakota Agricultural Experiment Station

AGRICULTURAL COLLEGE
NORTH DAKOTA

TO

THE GOVERNOR OF NORTH DAKOTA

1914

LETTER OF TRANSMITTAL

Agricultural College, North Dakota

February 1, 1914.

The Honorable L. B. Hanna,

Governor of the State of North Dakota.

Sir:—As required by Act of Congress, approved March 2, 1887, I hereby submit the Twenty-fourth Annual Report of the North Dakota Experiment Station for the year ending February 1, 1914, together with a financial statement of receipts and disbursements, as required by law, for the government of fiscal year ending June 30, 1913. This report is made by J. H. Worst, LL. D., who held the office of Director of the Station until January 1, 1914.

Respectfully,

C. E. NUGENT,

President of the Board of Trustees

North Dakota Agricultural College.

STATION STAFF

BOARD OF TRUSTEES

C. E. NUGENT, President, Fargo, N. D.
G. H. HOLLISTER, Fargo, N. D.
CLARK W. KELLEY, Devils Lake, N. D.
PETER ELLIOTT, Fargo, N. D.
ALEX STERN, Fargo, N. D.
EUGENE WEIGEL, Hebron, N. D.
J. FRED JENSEN, Westhope, N. D.
W. A. YODER, Secretary, Agricultural College.
F. A. IRISH, Treasurer, Fargo.

THOMAS P. COOPER, B. S. A., Director.

AGRICULTURE

J. H. SHEPPERD, M. S. A., Vice-Director and Agriculturist.
W. B. RICHARDS, B. S. A., Assistant Agriculturist (Animal Husbandry).
R. C. DONEGHUE, M. S. A., Assistant Agriculturist (Soil Investigations).
O. W. DYNES, M. S. A., Assistant Agriculturist (Plant Breeding and Poultry).
C. F. CHASE, B. S., Assistant Agriculturist (Engineering).
G. L. MARTIN, B. S. A., Assistant Agriculturist (Dairying).
E. J. THOMPSON, B. S., Assistant Agriculturist (Animal Husbandry).

BIOLOGY

H. L. BOLLEY, M. S., Botanist and Plant Pathologist.
W. B. BELL, Ph. D., Assistant Biologist (Economic Survey).
E. S. REYNOLDS, Ph. D., Assistant Botanist (Mycology and Plant Survey).
C. J. T. DORYLAND, M. S., Assistant Botanist (Soil Bacteriology).
O. A. STEVENS, B. S., Assistant Botanist (Seed Analysis).
D. G. MILBRATH, A. B., Assistant Botanist (Mycology and Histology).
NEVADA S. EVANS, M. A., Assistant Botanist (Seed Analysis).
W. H. MERCER, B. S. A., Assistant Botanist (Plant Breeding).
G. E. MILLER, A. M., Assistant Botanist (Economic Survey).

CHEMISTRY

E. F. LADD, B. S., Chemist.
W. F. SUDRO, B. S., Assistant Chemist (Beverages).
R. E. REMINGTON, A. B., Assistant Chemist (Foods).
W. L. STOCKHAM, M. S., Assistant Chemist (Oils and Cereals).
J. W. INCE, A. M., Assistant Chemist (Soils).
H. L. WHITE, M. A., Assistant Chemist (Cereals).
ADOLPH ZIEFLE, Ph. C. B. S., Assistant Chemist (Drugs).
L. A. CONGDON, B. S., Assistant Chemist (Foods).
LEVI THOMAS, M. S., Assistant Chemist (Baking).
A. F. SCHLICHTING, B. S., Assistant Chemist (Drugs).
C. T. GUTHRIE, B. Ph., Ph. C., Assistant Chemist (Drugs).
J. H. WRIGHT, M. S., Assistant Chemist (Microscopy).
W. F. WASHBURN, M. S., Assistant Chemist, (Paints).
RALPH DARNER, A. M., Assistant Chemist (Oils and Varnishes).
ADELE SHEPPERD, Assistant Chemist (Waters).
THOMAS SANDERSON, Miller.

HORTICULTURE AND FORESTRY

C. B. WALDRON, B. S., Horticulturist and Forester.
H. O. WERNER, B. S., Assistant Horticulturist.

VETERINARY

LEUNIS VAN ES, M. D., V. S., Veterinarian.
STEPHEN O'TOOLE, D. V. M., Assistant Veterinarian.
A. F. SCHALK, D. V. M., Assistant Veterinarian.
C. V. KENNEDY, Farm Foreman.

SUB-STATIONS

O. A. THOMPSON, B. S., Superintendent at Edgeley.
L. R. WALDRON, M. A., Superintendent at Dickinson.
E. G. SCHOLLANDER, B. S., Superintendent at Williston.
E. D. STEWART, B. S., Superintendent at Langdon.
W. R. LANXON, Superintendent at Hettinger.

DEMONSTRATION FARMS

W. R. PORTER, M. S. A., Superintendent.
AMOS EWEN, B. S., Assistant Superintendent.

REPORT

To the Board of Trustees of the North Dakota Agricultural College and Experiment Station:

Gentlemen:

I have the honor to submit herewith the Twenty-fourth Annual Report of the North Dakota Agricultural Experiment Station.

The following bulletins were published during the year:

No. 103. Cropping to Flax on New Lands of Semi-Arid Land Areas, by H. L. Bolley and W. L. Wilson.

No. 104. Cost of Producing Farm Crops, by W. R. Porter.

No. 105. Windmill Electric Lighting and Power, by Wallace Manikowske.

No. 106. (1) The Fertility Constituents of Flax, by J. W. Ince.
(2) The Feeding Value of Flax Material, by J. W. Ince.
(3) The Distribution of Prussic Acid in the Flax Plant, by J. W. Ince.
(4) Influence of Bran Extract on the Baking Quality of Flours, by H. L. White.
(5) Phosphorous Content of Wheat and Flour and Its Relation to the Baking Qualities of Flour, by H. L. White and R. F. Beard.

No. 107. Wheat: Soil Troubles and Seed Deterioration, Causes of Soil Sickness in Wheat Lands, Possible Methods of Control, Cropping Methods with Wheat, by H. L. Bolley.

PRESS BULLETINS

No. 58. The Fanning Mill and Good Flax, by H. L. Bolley.

No. 59. Flax, Wheat, Oats, Barley; Good Seed and Normal Crops for North Dakota—How to Get Them, by H. L. Bolley.

WORK OF THE EXPERIMENT STATION

The work of the Experiment Station for the past year is briefly outlined in the following pages by the various heads of departments. The work as developed and carried out was under the direction of J. H. Worst until January first of this year, as has been that of the several Sub-stations and Demonstration Farms. This report has been prepared under his direction.

Respectfully,
THOMAS COOPER,
Director.

AGRICULTURAL DEPARTMENT

President J. H. Worst:

Sir:—There has been no change in the staff of workers in the Agricultural Department except the resignation of Prof. W. B. Richards consequent to a sudden attack of a severe illness which occurred Nov. 15th, 1913. The position, as you are aware, has not been filled and the work has, of course, suffered from the sudden withdrawal which his ailment made necessary.

Two bulletins have been issued during the past year: bulletin 104 entitled The Cost of Producing Farm Crops by W. R. Porter, and bulletin 105 entitled Wind Mill Electric Lighting and Power by Wallace Manikowske. The latter was submitted as a thesis for a bachelor of science degree in agriculture in the North Dakota Agricultural College.

Correspondence during the past year has been heavy and indicates that certain bulletins or circulars should be provided which will supply the information asked for. The awakening of the people of the state to the fact that it is advisable and necessary to include live stock in the state's products stimulates their request for specific information. All inquiries have been given replies.

The work of the Agricultural Department during the past year has followed the general lines that I have reported to you in the twenty-third annual report for the year 1912.

The whole of the energies of this Department of the Experiment Station have been directed toward securing facts bearing upon diversified cropping systems and the keeping of live stock on the agricultural lands of the state.

The work outlined for determining what fertilizing ingredients will be required under live stock and what in grain farming to maintain the fertility has been somewhat extended and carried on in the

form previously outlined. As explained in the earlier report, this must necessarily be a long drawn out trial before positive conclusions can be made.

The plan which I have described heretofore of keeping account of each field crop experiment enterprise in measures of its cost is being continued and is placing me in a position to very much more readily estimate the probable cost of experiment work.

The hogging off of corn, peas and other cereals has proved a valuable lot of trials which I would recommend be carried on for a number of years to come.

Trials with corn growing have been continued and extended.

Clover trials and the extension of the crop in the east one-third of the state has received considerable attention during the past year and has met with a response that is gratifying.

The trial of field peas in the drier regions of the state has also been prosecuted with some vigor.

A large amount of time and energy has been devoted to the study of alfalfa and to the extension of this crop into the different districts of the state. The growing of alfalfa in cultivated rows for seed production and for forage yield has received a goodly share of the time of the Department. The improvement and production of heavy yielding strains of the different types of grain and forage crops and the distribution and extension of them in the hands of our people has also had attention from the Department.

The sealing of seed grain begun in 1911 has been continued and is proving a very satisfactory way of distributing seed without its losing its known identity. The Department through the sub-stations and demonstration farms has this year produced and is offering for distribution by sale under certified lead seal, 8,767 bushels of seeds, enough to supply at least the more urgent demand.

The work on potatoes and potato growing has been prosecuted with much more vigor than heretofore.

The experiment on the cost of production of milk and butter, the study of types of cows and the feed requirements for different individuals is being carried out along the lines reported in bulletin No. 91. The accumulated data from this trial is proving very valuable at this time, particularly as the interest in that class of production has been so outstanding during the past season.

Poultry trials have been carried on as outlined in the twenty-third annual report submitted for 1912.

The work of the twenty-four demonstration farms has been submitted in a separate annual report.

The work of the sub-stations at Edgeley, Dickinson, Williston and Langdon has been reported and published as separate documents and will not be reviewed here.

The report of the Hettinger Sub-station has also been handed to you. As explained in the twenty-third annual report, the work at Hettinger has been very closely curtailed on account of the lack of funds. A herd of milk cows has been placed on the sub-station, however, and a rotation of crops instituted on the farm. While the work of this sub-station must be demonstrational in its character almost exclusively until funds are available, it is nevertheless giving valuable information and spreading the interest in mixed farming and live stock production in that portion of the state.

The experimental results secured during the past year are largely attributable to the efforts of my co-workers in the Department. Their responsibility is accredited very largely in the published records we have put out in bulletin form and in the form of sub-station and demonstration farm reports. My thanks are hereby tendered to them for their efficient service.

Respectfully submitted,

J. H. SHEPPERD,

Agriculturist and Vice-Director.

CHEMICAL DEPARTMENT

To J. H. Worst, Director:

Sir:—The present is the Twenty-fourth Annual Report made by the writer as Chemist of the Experiment Station, and covers the year of 1913. During the year an exceptionally wide range of subjects has been covered not only in connection with research work, but also problems in connection with Agricultural Chemistry and with the enforcement of the Food and Drug Laws which it is made the duty of this Department to enforce. Numerous lines of research work have been carried on in connection with regulations under the provisions of the police work. The results of these experiments are either given in the Annual Reports of the Station or in Special Bulletins published by the Department.

The work of the Department of Chemistry has been divided, as in previous years, in several divisions with a chief at the head of each. The principal divisions with the heads of the same are as follows:

1. Agricultural Chemistry—J. W. Ince.
2. Industrial Chemistry—W. F. Washburn.
3. Oil Testing Laboratory—R. W. Darner.

4. Food Chemistry—R. E. Remington.
5. Physiological Chemistry—H. L. White.
6. Water Analysis—Adele Shepperd.
7. Pharmacy—A. Ziefle.
8. Beverages—W. F. Sudro.
9. Milling Experiments—T. Sanderson.
10. Flour Testing—W. L. Stockham.
11. Baking and Testing Laboratory—L. M. Thomas.
12. Illuminating Oils and Gasolines—W. L. Stockham.
13. Materia Medica—A. F. Schlichting.
14. Micro-Chemistry—J. H. Wright.
15. Inspection—L. A. Congdon and C. P. Guthrie.

Between the several divisions it is impossible to draw a sharp line as each must to a considerable extent overlap the work of the other, and at times several must attack together a problem in order to most expeditiously gain the information that is desired.

Briefly I present, herewith, the summarized report of J. W. Ince for the Division of Agricultural Chemistry:

"I herewith present my fifth Annual Report for the Division of Agricultural Chemistry for the year ending February 28th, 1914. The work of this Division for the past year has been partly a continuation of that outlined in previous reports and partly routine analyses.

ANALYTICAL WORK

The following is a very brief outline of the analytical work done the past year in this laboratory:

Fertilizers, (complete analysis), 2; stock foods,* (complete analysis), 10; stock foods,* (examination for constituents), 17; paris greens, 5; lead arsenates, 10; sulfur sprays, 5; soluble oils, 2; Bordeaux, 1; soils, (partial analysis for alkali), 9; soils, (complete analysis), 14; sugar beets, (for sucrose and purity coefficient), 176.

FIELD WORK

We continued some field experiments upon the following projects:

18 variety trials upon sugar beets at the College Station.

18 variety trials upon sugar beets in co-operation with 394 farmers.

Weed and crop experiments; the moisture and fertility in weeds and their effect upon crops with which associated.

*These do not include analyses of flax samples reported in Bulletin No. 106 of the N. D. Experiment Station.

Spraying; a study of new sprays; the effect of sprays upon plants.
The effect of fertilizers upon corn, flax and potatoes.
Straw rotting and nitrification.
Co-operative experiments with the Agricultural Department.

GREENHOUSE

Basic slag co-operative experiment with a committee from the Association of Official Agricultural Chemists of this country.
Studies upon plant nutrition, flax and wheat.
Studies upon nitrification.
The rotting of straw under different conditions.

MUSEUM

During the past year this Division made a special effort to secure samples of agricultural materials, partly for use as standards and partly for exhibition purposes in connection with the College. We have been able, by the generosity of the manufacturers and dealers, to secure the nucleus of a splendid collection. This collection has already proved its worth for reference work in stock food analysis, insecticides and fertilizers.

PUBLICATIONS

We have written for publication three papers contained in Bulletin No. 106, entitled "The Fertility Constituents of Flax," "The Feeding Value of Flax Material," and "The Distribution of Prussic Acid in the Flax Plant." We also wrote a series of five articles for the use of the Extension service of the Station. Our report upon the results of the 1913 sugar beet experiments has been completed and is ready to print.

NEEDS OF THE DIVISION

The work of this Division is very much diversified. There are a great many demands made upon it, and a large number of samples have steadily accumulated during the past year. It is impossible to keep ahead of this material. We have on hand now in this laboratory enough work upon soils alone to keep two experienced graduate chemists busy for a year. Moreover, at the present time we have data for a number of reports that cannot be completed because of lack of time. Our great need, therefore, is experienced analysts to help carry on the details of routine and investigational work upon soils and allied subjects.

ACKNOWLEDGEMENT

In closing I wish to express my appreciation for the assistance of the following young men who have worked in this laboratory for various portions of the year, Messrs. Earl B. Hunt, Reginald Colley, Gilbert Stafne and Vernon Ladd.''

Respectfully submitted,

(Signed) J. W. INCE.

During the year 12 special bulletins have been published dealing with various lines of work, and Station Bulletin No. 106 already referred to.

Each of the Divisions named has devoted its time to problems of research and routine work as found necessary, and each year the demand made by the general public for analytical work and experiments to be carried on by the Department, has increased until to-day, especially in the division of Agricultural Chemistry, it is impossible to do the routine and miscellaneous lines of work as requested by the poeple of the state and, at the same time, successfully carry out lines of research work that have been undertaken.

METEOROLOGICAL RECORDS

I present herewith the meteorological records for the year 1913 and, at the end, a summary for the years 1910 to 1913, inclusive, as no records have been published of weather conditions since the burning of our laboratory in 1909.

DAILY TEMPERATURE—1913.

Date 1913	January		February		March		April		May		June		July		August		September		October		November		December	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
1	32	20	— 8	—27	18	0	54	28	87	31	82	52	80	57	82	54	86	62	72	49	41	19	41	26
2	31	9	5	—27	4	—17	57	37	41	33	73	51	70	50	88	55	95	53	73	37	50	29	34	32
3	12	3	17	—26	25	2	40	34	41	34	76	45	75	59	98	58	74	63	74	48	57	27	38	30
4	12	— 7	— 7	—26	14	0	42	29	69	36	66	50	73	54	80	57	74	62	74	48	49	23	38	31
5	8	—20	—10	—20	35	5	48	32	57	34	74	52	72	53	88	62	82	62	48	44	55	28	43	25
6	—11	—27	2	—15	8	— 5	55	34	57	31	82	43	72	56	81	54	91	67	48	39	57	38	42	22
7	—12	—26	12	— 4	19	— 3	47	34	61	42	60	36	80	57	81	63	87	58	44	33	57	36	35	9
8	— 1	—26	22	0	32	13	41	31	52	31	64	43	82	64	82	49	73	61	57	38	47	25	21	10
9	17	— 8	12	0	46	22	35	33	51	33	67	46	86	56	81	58	78	60	63	37	40	25	42	20
10	20	— 5	24	8	39	27	14	32	56	34	70	46	74	53	69	57	70	44	68	42	31	11	44	20
11	1	—21	25	—10	44	29	50	29	64	46	75	50	77	63	62	57	72	39	49	53	31	12	43	20
12	—11	—32	1	—24	33	25	56	34	63	48	82	59	70	57	82	60	74	44	54	31	43	26	50	21
13	— 7	—30	25	—17	35	28	62	35	73	33	88	60	68	52	82	62	74	53	57	30	44	18	48	20
14	11	—17	32	15	32	11	70	35	53	34	84	63	71	59	86	65	78	56	71	45	33	10	49	12
15	24	— 1	29	5	20	0	77	44	47	38	90	66	81	65	94	73	70	53	59	29	34	13	34	13
16	24	0	24	5	20	4	86	50	62	39	90	56	81	65	89	61	70	44	48	30	38	27	47	20
17	35	— 7	24	14	16	9	78	49	66	45	77	54	80	62	87	59	75	53	53	31	56	33	50	19
18	— 4	—16	36	18	36	16	69	42	56	32	73	56	82	55	82	61	78	54	54	28	60	29	35	15
19	13	—15	34	13	18	11	60	32	59	42	84	61	82	55	76	63	58	38	55	27	33	27	40	15
20	5	—22	19	7	11	— 8	63	39	49	39	76	50	77	51	78	62	....	....	32	23	42	31	21	3
21	9	—21	18	1	11	— 4	58	42	46	40	79	50	79	53	88	60	53	30	27	12	51	38	18	3
22	15	—15	19	4	17	— 5	78	47	49	35	82	59	85	60	72	51	48	27	31	18	45	28	11	4
23	27	— 9	15	— 2	28	0	81	44	68	44	85	63	76	51	80	57	54	37	48	26	32	18	31	9
24	10	— 7	13	— 2	25	10	53	40	74	40	86	68	70	47	82	52	41	39	60	32	42	24	29	5
25	13	0	26	0	16	— 3	50	31	64	46	88	59	77	57	92	59	44	40	62	33	47	25	15	—12
26	37	— 6	29	—13	18	— 2	43	29	62	47	81	60	76	60	86	50	50	36	42	25	43	28	9	—12
27	10	— 6	4	—12	20	— 1	38	25	79	53	84	58	88	54	80	61	69	40	40	27	39	32	21	9
28	10	—10	9	—11	27	8	58	32	94	64	89	64	72	49	75	53	75	43	40	14	44	35	18	5
29	35	3	....	....	49	25	71	55	90	59	95	75	78	58	76	49	77	43	23	8	45	35	26	8
30	28	16	....	....	53	35	82	58	90	54	89	61	94	60	82	57	75	47	26	10	46	25	24	12
31	19	—19	....	....	48	30	....	....	80	57	....	....	85	57	74	54	....	....	36	18	....	....	29	13
Sum	399	322	451	—146	817	264	1742	1116	1960	1274	2391	1656	2413	1749	2525	1792	2145	1498	1580	965	1328	775	1026	497

SUNSHINE—1913.

Date 1913	January		February		March		April		May		June		July		August		September		October		November		December	
	Hr.	Min.	Hr.	Min.	Hr.	Min.	Hr.	Min.	Hr.	Min.	Hr.	Min.	Hr.	Min.	Hr.	Min.	Hr.	Min.	Hr.	Min.	Hr.	Min.	Hr.	Min.
1	7	15	7	35	3	15	10	15	1	....	14	30	12	45	13	15	7	....	7	....	6	50	....	....
2	6	10	1	35	3	15	....	10	....	20	11	40	7	20	12	....	8	50	9	50	6	5	....	....
3	5	45	6	45	9	50	7	....	9	40	13	40	9	10	12	15	3	15	8	30	7	35	....	....
4	7	15	5	35	6	40	12	20	9	....	7	50	2	20	11	30	10	10	0	0	7	15	3	....
5	7	5	1	55	9	10	10	50	12	15	10	20	10	35	12	10	9	50	0	0	4	20	5	25
6	7	45	5	15	8	15	8	5	11	45	14	10	14	10	12	40	6	10	0	0	....	....	4	45
7	7	45	3	35	5	55	5	10	5	25	14	35	13	35	8	....	8	50	4	10	....	....	6	35
8	7	55	8	....	7	40	8	....	10	15	14	30	12	5	9	30	9	45	7	....	6	55	6	50
9	7	15	7	....	3	15	7	15	13	....	14	35	14	20	1	....	8	15	3	20	....	....	4	30
10	5	15	....	25	10	15	11	....	10	30	14	20	8	50	....	10	3	....	0	0	4	50	5	20
11	7	55	6	35	0	0	12	45	1	50	14	....	2	15	7	35	11	....	2	15	....	30	6	45
12	7	5	7	55	....	25	13	....	11	45	14	20	3	50	7	45	10	45	7	35	....	....	4	50
13	7	45	3	30	3	....	13	10	10	10	14	5	10	....	7	....	10	....	8	40	....	....	6	40
14	7	20	....	10	8	15	13	10	....	20	12	20	8	40	9	50	8	40	6	....	....	....	4	20
15	7	50	3	30	10	40	13	5	5	40	14	20	9	....	9	50	3	35	5	40	....	....	5	10
16	8	....	5	45	9	15	13	5	10	15	0	0	10	40	5	40	6	10	7	55	*	*	6	45
17	7	10	2	5	4	30	13	10	9	20	10	10	9	....	0	0	9	10	7	....	*	*	6	40
18	7	15	....	10	2	40	13	10	13	30	13	50	13	35	2	40	8	20	4	40	....	....	6	5
19	7	15	2	5	3	35	13	30	3	40	8	30	11	45	3	50	1	55	....	40	....	....	2	15
20	8	30	5	35	7	35	13	....	....	15	13	40	13	40	*	*	9	15	....	30	....	....	5	15
21	8	35	1	35	10	50	13	25	2	25	14	25	12	30	9	40	9	20	0	0	....	....	5	35
22	7	40	3	35	9	20	4	30	13	30	14	10	9	25	11	45	10	10	4	40	2	50	5	45
23	8	45	7	40	1	30	6	30	13	10	14	....	11	35	7	45	0	0	....	25	4	45	5	5
24	8	15	7	25	9	55	7	....	9	30	7	10	13	20	11	30	0	0	7	50	7	30	1	10
25	9	....	8	40	10	5	8	....	13	....	11	30	11	5	11	35	....	25	0	0	7	20	5	50
26	9	....	9	10	9	50	8	30	11	15	12	10	10	40	11	35	10	15	3	25	4	....	....	....
27	8	45	9	10	10	10	12	50	14	30	11	50	10	35	....	25	10	15	0	0	....	....	....	30
28	8	15	8	25	10	15	12	55	11	35	11	50	8	....	9	35	10	15	0	0	....	....	1	5
29	5	30	....	....	11	35	12	15	12	45	8	55	11	35	11	....	8	55	0	0	3	30	....	....
30	2	50	....	....	4	40	12	....	14	15	14	10	12	....	....	25	9	30	0	0	5	10	....	....
31	5	30	....	....	11	55	....	....	7	40	....	....	13	....	11	....	....	....	4	10	....	....	....	....
Sum	227	35	140	40	217	30	309	5	273	30	363	35	321	20	243	55	223	....	111	15	79	25	116	10
Mean	7	18	5	1	7	1	10	18	8	48	12	6	10	18	8	6	7	42	3	30	2	48	3	45

* Out of order.

Date 1913	January	February	March	April	May
1	.....	trace	trace	.....	.10
2	trace	.....	trace	trace	.....
3	.....	trace	trace	.22	.21
4	trace	.....	trace	.....	.....
5	trace	.....	trace	.....	.....
6	.....	trace	.....	.....	.....
7	.....	trace	.04	.....	trace
8	.....	trace	.....	.23	.02
9	.....	trace	trace	.01	.....
10	.....	.....	.....	trace	.....
11	.....	.....	.....	.....	trace
12	.....	.....	trace	.....	trace
13	trace	.....	.05	.....	.....
14	.....	.....	.03	.....	.....
15	.....	trace	.....	.....	.43
16	.....	trace	.03	.....	.12
17	trace	.....	.03	.....	trace
18	.....	.....	.03	.....	trace
19	trace	trace	.03	.....	.....
20	.....	trace	.02	.....	.26
21	.....	trace	.01	.19	trace
22	.....	.....	.....	.04	trace
23	.....	.....	.....	.15	trace
24	.....	.....	.01	.03	.....
25	.07	trace	trace	.....	.....
26	.....	trace	.....	snow tr.	.....
27	.05	.....	.....	.....	.....
28	trace	trace	.....	.....	.....
29	.02	.....	.....	.....	.....
30	.02	.....	.08	.....	trace
31	.03	.....	.....	.....	.....
Sum	.19	.....	.36	.87	1.14
Mean	.006	.....	.01	.02	.03

3y Inches)

y	August	September	October	November	December
.....	.....	....	trace	.....	.....
.....	.....	.... .	.....	.....	.01
.04	....	. .....	.....	trace	.. ....
race	.. . .	.55	trace	.....	.....
.90	.. .	. .	1.57	.....	. .... .
race	. .	.12	trace	trace	....
....	. .....	.02	.26	.....	.....
... .	trace	....	.....	... .	.....
... ..	.04	1.00	.....	.....	.....
.....	.19	.21	.13	.....	. .....
.07	.10	..	.....	... .	.....
.08	.....	.....	.....	.....	....
race	.07	.....	.....	tr. snow	.....
race	. ....	trace	. .....	..... .	.....
.....	.....	.....	.....	.02	....
.07	..	. .... .	... ...	.....	.. .. .
.... .	.12	.... ..	.	....	.....
.....	.66	.....	.....	.....	....
race	.....	.....	snow tr.	. ....	....
.....	.86	.....	.....	.....	....
.....	.38	..... .	trace	trace	.. ..
.59	.....	.....	trace	..... .	... .
.....	.....	....	.....	.06	..... .
.....	.....	.13	.22	....	trace
.....	. .. ..	trace	.43	.....	trace
race	.....	trace	.....	.....	.....
.....	trace	.....	.....	trace	trace
.....	.....	.....	trace	trace	trace
.....	.....	..... .	.....	trace	.. ....
.73	.....	.....	....	trace	.....
.....	trace	.....	.....	.....	.....
2.48	2.42	2.03	2.61	.08	.01
.08	.08	.06	.08	.0002	.....

WIND—1913. (By Miles)

Date 1913	January	February	March	April	May	June	July	August	September	October	November	December
1	492	399	lost	269	503	349	276	275	393	373	377	99
2	345	507	lost	397	296	402	329	322	251	317	294	169
3	256	389	358	521	360	271	206	239	403	437	404	208
4	380	517	311	294	322	298	258	257	242	525	382	282
5	271	541	741	278	425	369	313	344	206	403	437	167
6	140	465	230	444	280	650	181	227	109	181	244	671
7	294	685	269	426	369	223	346	432	333	249	694	455
8	541	318	402	250	485	327	359	310	302	295	277	447
9	522	253	193	345	207	494	292	161	682	371	484	367
10	361	781	248	542	428	645	443	281	239	551	157	287
11	312	412	343	341	542	683	361	181	222	346	413	345
12	174	385	266	312	537	527	618	313	208	275	294	273
13	361	408	615	229	502	432	223	187	290	355	297	302
14	382	414	1169	485	288	216	285	303	608	373	202	268
15	179	354	462	411	199	296	194	368	127	158	358	375
16	507	322	412	572	193	203	190	299	231	197	*	299
17	447	304	505	619	365	339	144	222	199	236	*	236
18	383	301	556	447	243	323	236	271	584	352	283	308
19	526	656	lost	261	281	256	343	368	508	607	257	410
20	299	232	lost	603	307	296	143	253	560	349	477	232
21	347	373	334	435	335	186	341	499	368	219	284	246
22	318	568	413	411	209	335	222	174	304	267	188	372
23	358	159	533	490	484	586	236	256	294	*	420	227
24	310	339	743	386	255	531	166	342	189	*	439	437
25	248	277	385	296	333	253	463	329	255	*	301	148
26	303	262	266	241	370	259	248	207	199	*	221	334
27	210	199	389	392	234	350	262	272	386	478	313	268
28	367	345	439	710	400	476	309	561	343	840	330	350
29	339	....	424	739	187	514	364	231	215	....	237	217
30	571	....	478	639	260	446	378	182	215	205	119	159
31	669	....	414	....	374	....	307	362	....	314	....	511
Sum	11212	11165	11898	12885	10543	11535	9036	9028	9465	9273	9183	9469
Mean	361	398	440	429	340	384	291	291	315	343	228	305

*Out of order.

MEAN MONTHLY TEMPERATURES, RAINFALL, SUNSHINE AND WIND.

RECORD FOR 1910.

MONTH	DAILY TEMPERATURE			Mean of Maxima Temperatures	Mean of Minima Temperatures	Total Rainfall—inches.
	8 a. m.	Noon	6 p. m.			
April	42	53	55	59	31	1.01
May	49	58	61	65	36	.88
June	66	75	77	82	54	.83
July	68	80	82	86	54	.88
August	60	74	75	79	50	.91
September	52	64	65	70	43	1.60
October	41	56	55	63	35	.59
November	20	27	26	30	16	.51
December	9	15	14	21	1	.19
Total	407	502	510	555	320	7.40*
Mean	45	56	56	61	35	.82

* No record for first three months of the year.

RECORD FOR 1911.

MONTH	DAILY TEMPERATURE			Mean of Maxima Temperatures	Mean of Minima Temperatures	Total Rainfall—inches.
	8 a. m.	Noon	6 p. m.			
January	4	1	2	9	—11	.24
February	2	12	14	54	— 4	.27
March	25	36	38	43	16	.02
April	38	48	49	52	30	1.70
May	54	65	69	70	43	4.07
June	65	74	78	81	55	1.84
July	65	75	77	82	53	2.76
August	60	70	72	76	56	3.19
September	51	61	63	68	44	2.29
October	38	47	47	53	34	.83
November	14	20	21	25	7	.05
December	13	18	18	23	9	.15
Total	429	527	548	636	332	17.41
Mean	35	44	45	53	27	1.45

MEAN MONTHLY TEMPERATURES, RAINFALL, SUNSHINE AND WIND—Continued.

RECORD FOR 1912.

MONTH	Daily Temperature 8 a. m.	Noon	6 p. m.	Total Maxima Temperatures	Total Minima Temperatures	Total Rainfall—Inches.	Total Wind—Miles.	Total Sunshine Hrs. Min
January	11	4.9	1.5	2	—18	.11	9312	
February	6.4	13	15	19	1	.04	9839	
March	13	24	27	29	8	.01	10571	
April	40	52	56	58	32	1.39	13019	235—10
May	51	60	64	66	56	2.91	12552	298—40
June	60	70	72	74	51	2.28	10273	346—30
July	64	74	76	80	56	2.29	8595	366—35
August	59	69	70	75	53	4.83	7448	306—20
September	50	60	60	65	44	3.66	9420	257—20
October	38	51	52	58	33	.04	11095	274—50
November	27	36	37	41	23	....	9843	186—40
December	14	20	22	28	7	1.04	11904	156—30
Total	433.4	533.9	552.5	595	354	18.60	123,871	2428—25
Mean	36.1	44.5	46	49	29	1.55	10,322	269—50

RECORD FOR 1913.

MONTH	Daily Temperature 8 a. m.	Noon	6 p. m	Total Maxima Temperatures	Total Minima Temperatures	Total Rainfall—Inches.	Total Wind—Miles.	Total Sunshine Hrs. Min.
January	—1	2	4	12	10	.19	11212	227—35
February	2	9	13	16	— 5	....	11165	140—40
March	14	21	24	26	8	.36	11898	217—30
April	41	53	56	58	37	.87	12885	309— 5
May	47	57	59	63	41	1.14	10543	273—30
June	62	73	76	79	55	3.22	11535	363—35
July	63	72	74	78	56	2.48	9036	321—20
August	65	75	78	81	58	2.42	9028	243—55
September	52	65	66	70	48	2.03	9465	223—00
October	35	45	46	51	31	2.61	9273	111—15
November	30	39	38	44	25	.08	9183	79—25
December	17	27	29	33	13	.01	9469	116—10
Total	427	538	563	611	377	15.41	124,692	2627—00
Mean	35	45	47	51	31	1.28	10,391	219—00

Respectfully submitted,

E. F. LADD, Chemist.

HORTICULTURAL DEPARTMENT

To J. H. Worst, Director.

Sir:

In addition to the regular lines of vegetable and fruit improvement outlined in previous reports, this Department has begun work on the problem of the improvement of plants propogated asexually. This is a question much debated by plant breeders and others and it also has its economic side as many nurserymen are offering to planters what are termed "pedigree" fruit trees, strawberry plants, etc.

In the spring of 1913 a considerable number of strains of strawberries claimed by the growers to be improved through asexual selection were planted by the side of those ordinarily grown and selected for comparison. These will come into bearing in 1914. While the abstract principle of the possibility of plant improvement may perhaps be conceded at the outset, yet the progress that certain nurserymen claim to have made in this direction needs to be tested as a matter of information and protection to the one buying plants.

The matter of adapting plants not entirely hardy to a climate of a given severity through the process of grafting them upon a perfectly hardy stock is often discussed and some work has been done along that line.

The Wealthy apple has the highest value of any of the sorts that can be grown in this state but it is somewhat lacking in hardiness. In the spring of 1913 a number of Virginia crabs were topworked to Wealthy as a further test of the possibility of growing that variety and others of similar hardiness without the present danger of loss from winter-killing.

In connection with our other variety tests of fruit a number of seedling raspberries and grapes were received from the fruit breeding farm of Minnesota and planted in 1913. Arrangements have been made with Supt. Haraldson who developed these for the different strains of new valuable fruits as fast as they are ready for distribution.

The injurious insects most commonly reported in 1913 were the wire worm and cut worm, though a number of them were commonly reported as doing serious damage. The damage done by wire worms was chiefly to grain fields at the time when the grain was germinating, resulting in many instances in the complete loss of the crop. Further damage was done in the fall to the potato crop, resulting in two instances to a loss of about half of the crop. The department

has kept in touch with those reporting damage and measures have been recommended for trial in 1914. The same applies to cutworms.

The added equipment for 1913 consists of one storage and two work rooms to the greenhouse at a cost of $1,650.00. Mr. Harvey O. Warner of the Pennsylvania State College began work in the department as assistant horticulturist on the first of September.

Respectfully submitted,

C. B. WALDRON.

DEPARTMENT OF BOTANY AND PLANT PATHOLOGY

Director J. H. Worst,

Sir:

I herewith submit the report of the Department of Botany and Plant Pathology for the year ending December 31st, 1913. According to your request the report of the year is made in outline not as to detail, but as to the general direction of the work in such manner as to indicate the chief results obtained.

The work of the Department of Botany and the allied work of the various general investigations in biological lines for the year 1913, have not in any particular plans been varied from that in previous years, except in so far as to carry out or modify the scope of the work to fit the results obtained in previous investigations. There has been some work done under each of the general sections of work assigned to the department. Most intensive effort has been placed upon the Adams Investigation bearing upon the work with the wheat-root diseases and the diseases of flax, particularly, the work of procuring resistant seed and information regarding the underlying principles involved in breeding work to procure seed of value for use upon lands into which constant cropping methods have introduced destructive crop diseases.

Adams Investigations: The investigation work done under the Adams Propositions 1, 2, 3 and 4 has been continued and most persistently directed upon wheat, flax and potatoes. These Adams Propositions were originally planned as distinct co-operative field and laboratory studies, whereby the workers in the laboratory and the workers in the field, work in close association and investigate similar problems under such conditions that the results of one worker would fit directly into that of another so as to give a unit result. The original field plots have been continued in the same shape and form, but the work in the field has been specifically guarded as to methods for specific purposes so that the laboratory workers could make use of

the same cereals and the same plots for their specific investigations in histology, bacteriology and pure culture work. In the early years of the work, while we were convinced that there were certain destructive diseases at work upon the roots of wheat, flax and specifically allied crops and plants, it was not at all clear just what particular diseases or fungus producers of diseases were at work nor had it been clear just what effect ordinary methods of cropping, tillage, fertilizing, etc., might have upon such fungus activities. Our efforts in arranging the plots and arranging the experiments have been specifically centered upon these during the present year, especially upon those of wheat. Every effort has been made to ascertain **the direct causal agents or classification of the fungi; their relation to the specific tissues of the diseased plant; and their relation to various types of fertilizers and methods of soil work as applied to the wheat-sick or constantly wheat-cropped soils.** Following the work of previous years, more specific attention has been paid to direct crop inoculation of the various cereals and closely allied plants with a view of ascertaining just what ones of the indefinite wheat-root fungi may be transmitted to other crops, as barley, oats, flax, corn, potatoes, etc., and further field studies have been made to ascertain the relation of certain wild plants to these same troubles.

The marked gains of the year have been the accumulation and perfection of specific methods of growing purified seedling plants under conditions which essentially exclude the presence of disease, and under conditions which admit of the introduction of any one or more. Studies upon such methods of seedling purification were started by the writer in 1906 and 1907, and were put into field operation on quite large plots in 1910-11-12, but until the close of 1912 were only tentatively clear as to the meaning of the results obtained. During the season of 1913, we have been able to conduct experiments upon such a basis as to make it evident that we are now able to practically purify seedling plants so that nothing but a pure culture of the crop which we wish to introduce into a pot, plat or plot need be placed there. The difficulties which surround the work in the open, however, are great because of the actions of wind and the difficulty of controlling questions of moisture or drouth, the shifting of dirt, dust and spores, etc., yet the results from this work show so conclusively that we are now able for the first time to place in bulletin form some of the details of the work indicating the general conclusions.

Hatch Investigations: Under the Hatch Investigations, we have conducted all those phases of preliminary experiments which involve

the study as to how to put the principles or information gained under the Adams Studies into direct or practical application in farm practice. We have had under way various types of seed investigation with regard to treatment or disinfection, comparison of varieties and strains in their powers to resist disease, studies on various varieties and strains for the purpose of selecting therefrom types that may possibly be more resistant than those now in use; attempts at cross-fertilization and selection for the purpose of obtaining possible resistant strains and particularly methods of carrying out the larger plot work involved in the efforts to determine proper crop rotations, proper tillage methods, proper fertilizing methods and proper methods of seed selection, seed saving and seed curing as affecting the main problem. There has also been done much work looking toward the increase of resistant types in sufficient quantities to be tried on plots under co-operation with farmers in various parts of the state to ascertain their value when placed under general agricultural conditions.

State Station Investigations: Under the funds furnished by the State to Station we have conducted certain minor preliminary tests not as well open to intensive or extensive investigation as indicated in the Adams and Hatch work. Under this fund, I have particularly directed the continuation of our weed investigation work.

The Economic Biological Survey Work: As in past years, this department has carried on or continued its work of collecting data upon the more specific economic plants of the state and particularly upon the effects of weeds, diseases and destructive native plants, including the poisonous plants of the state. Aside from the State Station fund, there has been no specific funds available to carry on this work, but, as in the past, I have made use of the experts connected with the department, who are particularly interested in these particular lines of study and have sent them to various parts of the state, where possible, to gain the information which is likely to be of most use to the future development of the department work.

Biological Survey Proper: During the summer months, as in past years, we have conducted a regular systematic biological survey over portions of territory not heretofore examined, and the work has been conducted as in the past in co-operation with the geological survey of the Agricultural College. On account of the resignation of Professor H. F. Bergman, who was in charge, the botanical phase of the work, particularly the study upon the native plants, the native plant survey was essentially discontinued this year. Professor Ernest Shaw Reynolds, who is teaching botanist of the College, being new

to the state and its resources was not directed to take up a specific phase of the botanical survey but was allowed to use his summer for general travel and investigation of plant diseases and native plants of the state with the specific view of becoming more thoroughly acquainted with conditions in this region, that he might continue his work of instruction in more co-ordinate manner as respecting the various localities of the state.

The chief work of Prof. Bergman during the years of his connection with the department is now being summarized in a specific reissue of Bulletin No. 46, "The Native Seed Bearing Plants of North Dakota." This work of Prof. Bergman, to which is being added economic features of interest is now essentially ready for the press. Bulletin No. 46 has been much used by the teachers of the state in their botanical class work and in their work in elementary agriculture.

Soil Biology by Prof. C. T. Doryland: As in previous years, we have continued a certain amount of work in bacteriological study of the flora of soils, especially of the wheat-sick and flax-sick soils. I have so planned these investigations that the work of the bacteriologist may be applied upon problems which will give enlightenment from the bacteriological side regarding the influence of minute organisms, particularly bacteria and indefinite fungi upon the character of the soil and upon the character of the crop produced thereon. During the season of 1913, this work of investigation has been carried on by Prof. C. J. T. Doryland and has been particularly directed towards the development of certain preliminary experiments with a view of ascertaining the more fundamental features underlying bacterial and fungus activities in the soil. Mr. Doryland has filed a complete report of his work and has made a number of suggestive recommendations in regard to the direction the work should take.

The Ammonifying Power of the Soil: One of the chief problems assigned to Mr. Doryland was the determination of the ammonifying power of the different plots of wheat soil as made out by the Department of Botany on the old continuously wheat-cropped lands of the Experiment Station. As indicated in previous reports and publications, these various wheat plots give various yields of straw and grain, and grain of various types as to quality and value. It has been quite commonly assumed by some writers that the cause of deterioration in seed production under the system known as the "constant one-crop system" is in large part due to a reduced ammonifying power of the soil, or at least to changes induced in bacterial rela-

tions with reference to ammonification. The Beaker method of testing the ammonifying powers was modified, improved and used in these experiments. Assuming that the Beaker method of determining the ammonifying power of the soil is reasonably accurate, the results as indicated in the tables constructed from the investigations of Mr. Doryland for two years upon these various fertilizer plots "do not indicate any material evidence that there exists any particular relationship between the ammonification power of the soil and the crop producing power of the same." "For example, the so-called "worn-out" or "exhausted" wheat-sick soil or flax-sick soil gave essentially as high ammonifying power as the new or virgin soils taken directly from under the sods of the native prairie." So also in the case of the fertilizer plots, regardless of what fertilizer was applied, there does not seem to be a material change sufficient to be definitely specified as a changed condition as to ammonification.

Two other problems were investigated by the department of bacteriology and when followed to their conclusions tend to indicate that the investigations will eventually yield results of some importance. These problems were as follows: (1) Proper investigation of the effects of continuous wheat cropping contrasted with certain types of crop rotation as effecting the number and kinds and types of activities of the bacterial flora of the soil; (2) Pot experiments to determine the effect of steam sterilization under high pressure upon the production of the so-called toxins which are believed by some to be able to inhibit the growth of the crop. Mr. Doryland also planned a careful set of plot experiments for the purpose of testing the effect of soil aeration upon the growth of the crop and upon the micro-organic flora of the same.

Work of Other Assistants: Assistant Botanist, Mr. Wm. Mercer, has conducted some careful investigations upon timothy rust, which for a number of years has been showing a tendency to increase in destructiveness in this region. A large number of cross-inoculation tests were made without avail. Mr. Mercer has reached the conclusion that the rust is rather specific in its relationships, growing almost exclusively upon timothy and being dependent for its destructive effects largely upon climatic conditions.

Assistant Botanist, D. G. Milbrath, has been very closely studying the micology and histology of wheat and flax disease producing fungi and of the host plants which these attack, and has been directly associated with me in the pure culture methods of seedling purification and cross-inoculation work to determine the inter-relationship,

if any, which exists between the fungus parasites which attack the various cereal crops and particularly the weed pests which are associated with the crops.

Assistant Botanists, O. A. Stevens and Nevada S. Evans, in charge of the Pure Seed Investigations, have carried on studies as previously outlined. Work has been done and reports and records filed upon the following features:

(1) Studies on the synonomy of varieties of oats, wheat and millet.
(2) Comparative germination of oats and barley in the laboratory and field.
(3) Study of hard seeds in alfalfa and other legumes.
(4) Studies of new and noteworthy weeds.
(5) Studies of quack-grass and related plants.
(6) Collection of additional specimens and seeds for reference collections.

Instruction in seed testing was given to seven student aids. These students later assisted in the actual work of testing during the latter part of the year.

Flax Fiber Investigations: We have continued the study upon flax fiber problems sufficiently to know (a) that usually fiber strains of flax are more resistant to disease than are the common varieties of seed producing flax; (b) that whenever there is demand for long line fiber, the Red River Valley can produce fiber flax of very good quality. Experiments have been conducted in the laboratory and in the field for a number of years to determine various possible methods of removing the fiber from common seed producing flax straw not for the purpose of outlining what that exact method should be, but with the primary idea of ascertaining if it can be done without destroying the fiber value. We have kept records of the character and strength of such fiber when removed and are convinced that there is much valuable fiber in such straw, but that ordinary processes of removing it result in largely injuring or destroying the fiber because of the brashness of the surrounding wood. This work will be continued sufficiently to allow us to give out necessary data; for I am convinced that the time will come when large use will be made of the fiber which is in common seed flax straw.

Breeding Flax for Oil Content: For two years we have been putting on preliminary studies for the purpose of determining the possibilities of improving the oil producing qualities of the seed flax varieties, and also to determine whether it is possible to increase the

oil content as to quantity and quality. These experiments have not run far enough to go further than to say that in procuring disease resistance we do not, apparently, lose oil producing capacity. This is a very valuable point if it proves to be true. The oil tests to date have been conducted in a preliminary manner specifically upon the resistant varieties, using common varieties as a check. The Department has always been in rather close co-operation with the Chemical Department and whenever our preliminary tests lead us to a point where the problem requires definite chemical investigations, arrangements have been made with Professor Ladd to carry on the actual chemical investigations in a larger way. Arrangements have been made whereby we will be able to furnish standard types of seed from different farms of the state in co-operation with this department, and from the Botanical breeding grounds for such chemical work. It is reasonable to expect that such tests may pave the way for a new step in flax crop improvement; for if the oil content and quality can be improved, we can probably hope for the crop to become more remunerative to the grower.

Respectfully submitted,

H. L. BOLLEY,

Dean of Division of Biology,

Botanist and State Seed Commissioner.

DEPARTMENT OF VETERINARY SCIENCE

Mr. J. H. Worst, President,

Agricultural College, N. D.

Sir:

In compliance with your instructions of the 27th ult., I beg to make the following report on the station work done by this department during the past annual period.

The work on "Swamp Fever in Horses" has been continued, but owing to lack of available animals infected by the disease, the investigation could not be pushed to completion as we had planned.

The work done, however, has about convinced us that the laboratory diagnosis of infection carriers by the methods now in use in other diseases is not applicable to swamp fever.

Attention has been paid to the nature of the disease as we meet it in our section as compared with that seen in other parts of the continent. Working with blood samples procured from fellow workers

in Texas and Alberta, we found that there does not seem to exist any noticeable differences in the disease produced with this material and that found occuring in this state.

The suspicion that the horse which, from a clinical standpoint has recovered from the disease, remains a source of danger to the healthy horse stock with which the animal comes into contact, was again confirmed by this year's experiments. Our experimental horse No. 636, which received its initial infection on September 9, 1908, and which to all appearances is in a state of perfect health conferred the disease to a susceptible horse by means of blood drawn exactly five years after initial infection.

During the past year a new project was undertaken. It pertains to the facts underlying the development of immunity against hog cholera and the production of serum against the disease. The work done so far in this project is of a preliminary nature, but we can state that unlike previous years a certain quantity of potent serum was produced, and that this is now being used for comparative studies.

Whenever time and material were available we have continued certain studies on avian tuberculosis begun during the early part of 1913 and made possible by a rather extensive outbreak of the disease among the chickens of the station.

As we are preparing a manuscript for a bulletin on the general subject of avian tuberculosis, it will probably not be necessary to describe our observations fully in this report.

We may state, however, that our experiments have largely had for their purpose the development of a reliable means of diagnosis and that apparently such method has been developed, by the intradermal use of tuberculin and the selection of the comb and wattles as the point of injection.

The following statement summarizes the work to date and the results thus far obtained:

Total number of fowls tested	588
Fowls tested and results checked by autopsy	259
Fowls found with lesions	118

Fowls with typical reactions	84	
Reacting fowls with lesions	82	or 97.61%
Reacting fowls without lesions	2	or 2.89%

Fowls without reactions 118
Non-reactors free of lesions .....109 or 92.38%
Non-reactors with lesions ..... 9 or 7.62%

Fowls with doubtful reactions 57
Doubtful reactions with lesions ..... 27 or 47.36%
Doubtful reactions without lesions ..... 30 or 52.64%

We have reason to believe that by the method now in course of perfection, it will be possible to eradicate tuberculosis from chickens in the same manner as we can now do from herds of cattle.

Respectfully,

L. VAN ES.

REPORT OF NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

Statement

United States Appropriations, 1912—1913.

	Hatch Fund	Adams Fund
Receipts	$15,000.00	$15,000.00
To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1913, under acts of Congress approved March 2, 1887, (Hatch Fund) and Mar. 16, 1906, (Adams Fund).	$15,000.00	$15,000.00
DISBURSEMENTS		
Salaries	11,042.94	9,754.04
Labor	3,199.48	1,326.03
Publications	.....	.....
Postage & Stationery	24.00	5.50
Freight & Express	.....	30.30
Heat, Light and Water	.....	8.25
Chemical Supplies	.....	772.15
Seeds, Plants & Sundry Supplies	56.25	282.53
Fertilizers	.....	25.90
Feeding Stuffs	9.95	528.80
Library	.....	31.21
Tools, Implements and Machinery	219.50	374.33
Furniture & Fixtures	235.00	8.40
Scientific Apparatus	155.98	1,177.66
Live Stock	.....	616.50
Traveling Expenses	56.90	40.90
Contingent Expenses	.....	.....
Building and Repairs	.....	17.50
Total	$15,000.00	$15,000.00